ate the problem. To gain lasting improvement, patients' maladaptive behavior must be corrected; such is not possible by pharmacologic means alone. The patient must be shown what he is doing incorrectly, and the change necessary to gain the desired benefits. This training must be conducted on a regular repetitive basis with expert coaching appropriate to the occasion.

To keep costs down and availability high we rely mainly upon standard hospital equipment. The "workhorse" is the spirometer with carbon dioxide absorber and recirculating fan and enough extra oxygen to last 15 minutes. The patient is positioned so that he can see his own tracing and a base line obtained. While watching his tracing, he is urged to change his performance in the desired direction. We also employ galvanic skin resistance meters for tension reduction and electromyogram equipment for muscle education in parallel sessions. Peak flow meters and self auscultation are used to teach early detection of bronchospasm and more effective assumption of preventive measures. Since respiratory control is a varying amalgam of voluntary and autonomic control, we show the overpressures generated during coughing and subsequent reduction in flow rates to the patient. He is shown how to phonate continuously during cough, to prevent this overpressure. We follow with use of a 3 cm (water pressure) expiratory valve to slow respirations, increase tidal volumes and promote opening of collapsed airways. Early identification of the *antitherapy* patient, who will require an entirely different approach, is an additional derivative of this methodology.

ROMAN L. YANDA, MD

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Value of Lung Scanning in Evaluating the Risk of Thoractomy

EQUAL IN IMPORTANCE to determining whether a lung lesion is resectable is whether or not the patient can survive the operation. To completely resect a malignant lesion of the lung but have the patient die in respiratory failure in the immediate postoperative period or be left a severe respiratory cripple is not acceptable.

A patient's ability to tolerate removal of a lung has been evaluated by such techniques as having the patient walk down the corridor with the physician, walk up stairs, or blow out a match. Recognizing that these are only rough guides to a patient's total respiratory function, more sophisticated methods for determining how much lung function would remain following a resection were developed. These included bronchospirometry and the determination of pulmonary artery pressure after occlusion of the pulmonary artery to the lung to be resected. Recently, it was shown that selective lung function can be determined *noninvasively* and relatively simply with the use of radioisotope lung scanning.

With the use of xenon 133 or technetium 99m, quantitative perfusion lung scans can be done which allow for estimates of the expected loss of function that would result from the anticipated resection of lung tissue. For example, the postoperative forced expiratory volume in one second (FEV_1) is predicted by multiplying the preoperative FEV_1 by the fraction of function that is found in the lung that is to remain after resection. Elective resection is inadvisable if the predicted postoperative FEV_1 is less than 0.8 liters, particularly without further studies such as balloon occlusion of the pulmonary artery to the lung to be resected.

JOHN E. HODGKIN, MD

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Evaluation of Small Airways Function

SMALL AIRWAYS of 2 mm in diameter or less constitute the largest total volume of conducting airways in the lung yet direct measurement of these structures is not yet routinely possible. However, several simple and not so simple tests are available which give good indirect evidence of a critical portion of the lung that Dr. Jere Mead of Harvard has called the "silent zone." It has long been appreciated by clinicians that malfunction leading to obstruction of airflow begins and progresses significantly before development of symptoms or abnormalities on conventional spirometry. A general nihilism toward pulmonary testing developed among clinicians over the years because tardiness of diagnosis led to advanced disease unresponsive to therapy, even when acted upon promptly after diagnosis.

When usual spirometric values show airways obstruction, the search for small airways disease (SAD) is redundant, even wasteful. Detection of SAD is the prerequisite to early detection of re-